



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/846,536	05/02/2001	Wen-Ting Chu	TS1999-646B	4121

28112 7590 07/16/2003

GEORGE O. SAILE & ASSOCIATES
28 DAVIS AVENUE
POUGHKEEPSIE, NY 12603

EXAMINER

NADAV, ORI

ART UNIT PAPER NUMBER

2811

DATE MAILED: 07/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/846,536

Applicant(s)

CHU ET AL.

Examiner

ori nadav

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 14 January 2003 is: a) ☐ approved b) ☒ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

Art Unit: 2811

DETAILED ACTION

Drawings

1. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 5/2/2001 have been disapproved because they introduce new matter into the drawings. 37 CFR 1.121(a)(6) states that no amendment may introduce new matter into the disclosure of an application. The original disclosure does not support the showing of a space between the metal spacers exposing a portion of a top surface of the recessed metal plug structure .

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 20-24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Originally filed figure 7B clearly depicts that there is no discontinuity (lack of connection or succession)

Art Unit: 2811

between the metal spacers such that a portion of a top surface of the recessed metal plug structure is exposed. The disclosure supports the illustration of figure 7B by not reciting that a discontinuity is formed between the metal spacers such that a portion of a top surface of the recessed metal plug structure is exposed. Therefore, there is no support in the disclosure for a discontinuity between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 20, insofar as in compliance with 35 U.S.C. 112, is rejected under 35 U.S.C. 102(b) as being anticipated by Harada et al. (5,341,026).

Harada et al. teach in figure 1 and related text a metal structure 100 on a semiconductor substrate 1, a via hole in an insulator layer 5 exposing a portion of an underlying lower level metal interconnect structure, a recessed metal plug structure 206 located in a bottom portion of the via hole, with the recessed metal plug structure 206 overlying and contacting the portion of the lower level metal interconnect structure 4, exposed in the via hole; and

Art Unit: 2811

the metal structure 100 comprised with a first portion 101, 102, 103 located on a smooth top surface of the insulator layer, and with the metal structure comprised with a second portion 103 attached to the first portion, wherein the second portion is a metal ring structure comprised of metal spacers located on the sides of a top portion of the via hole (not including the center of the via hole) and located overlying only portions of a top surface of the recessed metal plug structure located at the bottom of the via hole, resulting in a discontinuity between the metal spacers at bottom of the via hole, wherein the thickness of the metal ring structure on sides of top portion of the via hole is greater than the thickness of the metal ring structure located on center portion of the metal plug structure.

Although Harada et al. do not explicitly state that layer 206 is a recessed plug, layer 206 can very well be characterized as a recessed plug, because layer 206 is formed in a bottom portion of the via hole, overlying, contacting and connecting the lower interconnect level 4 to the upper interconnect level. Therefore, Harada et al. teach a recessed plug, as claimed.

Art Unit: 2811

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 21-24, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada et al. (5,341,026).

Regarding claim 21, Harada et al. teach a lower level metal interconnect structure with an underlying and overlying titanium tungsten layer. Harada et al. do not teach a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms in Harada et al.'s device in order to protect the lower level metal

Art Unit: 2811

interconnect structure with conventional barrier layer, of which official notice is taken, and because it is well within the skills of an artisan to use a lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, and underlying and overlying layers of a thickness between about 100 to 1500 Angstroms, respectively, in order to provide adequate conductivity to the device. Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979. Note further that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claims 22-23, Harada et al. teach a recessed metal plug structure comprised of tungsten. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms in Harada et al.'s device, because it is well within the skills of

Art Unit: 2811

an artisan to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms, in order to reduce the size of the device and in order to provide adequate conductivity to the device, respectively. Note that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claim 24, Harada et al. a metal ring structure 103 comprising aluminum spacers.

Response to Arguments

8. Applicant argues that there is support in the disclosure for a discontinuity between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20, because discontinuity refers to the difference in thickness between the metal spacers.

Art Unit: 2811

Discontinuity is not defined as the difference in thickness between two elements, but rather as the lack of connection or succession between the two elements.

Therefore, discontinuity between the metal spacers means lack of connection or succession between the metal spacers. There is no support in the disclosure for lack of connection or succession (discontinuity) between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20.

9. The rest of applicant's arguments with respect to claims 20-24 have been considered but are moot in view of the new ground(s) of rejection.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Art Unit: 2811

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas, can be reached at **(703) 308-2772**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

A handwritten signature in black ink, appearing to read 'Ori Nadav', is positioned above the printed name and title.

O.N.
July 14, 2003

ORI NADAV
PATENT EXAMINER
TECHNOLOGY CENTER 2800